

A RETROSPECTIVE STUDY OF FINDINGS AND CHALLENGES IN CONDUCTION OF COVID-19-POSITIVE AUTOPSIES

MANPREET KAUL, JASPINDER PRATAP SINGH*, KULDIP KUMAR, SUNNY BASRA

Department of Forensic Medicine and Toxicology, Government Medical College, Amritsar, Punjab, India. Email: jaspinderpsingh@gmail.com

Received: 11 September 2022, Revised and Accepted: 28 October 2022

ABSTRACT

Objectives: In this article, we report our observations as well as the innovations which were adapted in the resource-limited settings which are present in most parts of the country. The standard protocols were adopted for complete COVID-19 autopsies that were conducted.

Methods: The present retrospective study was conducted in the Department of Forensic Medicine and Toxicology, Government Medical College, Amritsar. The medicolegal autopsies were conducted completely in confirmed positive COVID-19 cases. In the medicolegal cases, complete autopsies were conducted, where the investigating officers did not forgo the autopsy. A total of ten COVID-positive autopsies were conducted from July 2020 to August 2021.

Results: Gross findings of various organs during autopsy include that of lungs showing relatively unremarkable lungs with mild edema and consolidation, brain showing edema, and subarachnoid hemorrhage, pancreas showing necrotic and hemorrhagic changes, and kidneys flea-bitten and were contracted.

Conclusion: Although a complete autopsy is desired to provide the best possible understanding of the disease process, its variants, such as core biopsies and echopsies, can be taken up as safer alternatives, especially in resource-limited centres. Experience, preparation, and experience are the significant vital aspects which help in managing the COVID-19-positive autopsy. The institution needs to develop guidelines as well as standard operating procedures for the smooth and safe conduct of autopsies in COVID-19 dead bodies.

Keywords: COVID-19 autopsy, SARS-CoV-2, Pandemic autopsy, Minimal invasive autopsy.

© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2023v16i1.46321>. Journal homepage: <https://innovareacademics.in/journals/index.php/ajpcr>

INTRODUCTION

The novel coronavirus SARS-CoV-2 was detected in the Wuhan district of China in December 2019 and was found as the causative agent of respiratory illness in humans (COVID-19). It is much related to other variants of such as SARS-CoV and MERS-CoV, other variants of human coronaviruses which were responsible for outbreaks of severe acute respiratory syndrome previously detected in China back in 2002–2003 [1]. While multiple guidelines had been issued from time to time regarding autopsy protocols in suspected or confirmed COVID-19 deaths, there is some variability in the recommendations [2-6]. However, autopsy studies in COVID-19-related deaths are still limited in comparison with the abundance of clinical-epidemiological studies [7]. The major reasons for this scarcity of data include logistical and biohazard concerns, where the requirements are too difficult to be met in this current pandemic situation [8], as the majority, there is in low-resource settings in the country. Undoubtedly, there is a need for a less invasive alternative and theoretically safer approach. Specific minimal invasive autopsy protocols adapted to different age groups have recently been developed for use in middle- and low-income countries [9,10]. Several guidelines recommend at least a BSL-3 autopsy facility to perform a complete autopsy safely in COVID-19 cases [11,12], whereas other guidelines alternatively recommend a negative pressure room [13] or whole room ventilation [14] with proper air filtration.

Aims and objectives

In this article, we report our observations as well as the innovations which were adopted in the resource-limited settings which are present in most parts of the country. The standard protocols were adopted for complete COVID-19 autopsies that were conducted. The limitations, scenario, technical details, and modifications of conducting autopsies of one of the most highly infectious diseased cases in India as well as other developing countries are compared and discussed with the techniques mentioned in the studies from the other developed western countries.

METHODS

The present retrospective study was conducted in the department of Forensic Medicine and Toxicology, Government Medical College, Amritsar. The medicolegal autopsies were conducted completely in confirmed positive COVID-19 cases. Routine autopsies on COVID-19-positive cases are not recommended as per Indian Council of Medical Research guidelines. However, in the medicolegal cases, complete autopsies were conducted, where the investigating officers did not forgo the autopsy. A total of ten COVID-positive autopsies were conducted from July 2020 to August 2021.

With the idea of conducting complete autopsies on COVID-19-positive cases in mind, a meticulous study of the recommendations was done by the authors. The recommendations those are provided by COVID-19: Guidelines on Dead Body Management [8], World Health Organization [15], the Center for Disease Control and Prevention [16], and Royal College of Physicians [11], for conducting the autopsies on highly infectious disease bodies.

The technical details specified in the published autopsy studies were also taken into consideration [4,17,18], and the working conditions in the mortuary attached to our department were tried to get developed as per the protocols.

These autopsies were those cases which were tested positive by RT-PCR, that is, real-time polymerase chain reaction, the most sensitive test available for COVID-19 detection.

After being prepared, the dead body was received in the mortuary, following the Dead Body Management guidelines [8]. The movement during the autopsy was restricted from in and out of the autopsy room [9], and it was ensured that all instruments (forceps, knives, trays, scalpel, camera, syringes, etc.), data entry forms, preservation solutions

(10% neutral buffered formalin, rectified spirit, normal saline, etc.), and 1% sodium hypochlorite solution were kept available in abundance inside the autopsy room. Labeling of the containers for viscera storage, packing material (boxes, plastic bags, and cling wraps), as well as viral transport medium vials was done before the start of any procedure.

The hospital notes of the patient were studied before the autopsy. To avoid soiling or contamination, the types of equipment, such as the camera and weighing machine, were wrapped with plastic cling wrap, which was discarded itself in the autopsy room after the autopsy. The packing materials that were required for sample preservation which included boxes, plastic bags, and cling wrap, were kept handy. Pre-autopsy preparation checklist was looked at before entering the autopsy room to avoid missing out on anything necessary. The autopsy procedures were conducted wearing full personal protective equipment (PPE) that included caps, N95 masks, shoe covers, double gloves, gown, goggles, gum boots, and a plastic apron. Both donning and doffing were taken care of as per the recommended protocols [19].

All the details regarding the external examination, such as the build, height, injuries, or any other relevant findings, were noted; also, the nasopharyngeal swab was taken for microbiological analysis. At first, the cranial cavity was opened after reflecting the scalp, and the skull was opened using a chisel and handheld hammer. Meninges were inspected, and the brain was removed, weighed, and examined for any kind of gross pathology like hemorrhage, edema, or swelling. Tissue from various parts of the brain was collected for histopathological examination; also, from the regions where any gross abnormality could be identified, samples were preserved, and the after putting the remaining brain back in the cranial cavity, the skull cap was replaced, and stitching of scalp was done.

An I-shaped incision was given in the midline from the chin extending to the pubis symphysis, Virchow's technique was followed, and the thoracoabdominal cavity was opened. Ribs were cut open with rib shear and to limit the spread of aerosols, care was taken, and the surrounding area was covered with gauze pieces. Any pleural or pericardial abnormality like adhesion or effusion in the thoracic cavity was noted.

The pericardium was reflected, giving T-shaped incision, and the heart was removed and weighed. Coronaries were looked for any occlusion, and samples from each chamber of the heart, IV septum, nodes, and any region, where gross pathology was suspected, were taken for histopathological examination. At first, the lungs were examined in situ and were carefully taken out one by one. These were firmly held using gauze to prevent any spillage and slippage. The lungs were weighed and examined. Samples for histopathological examination were taken, and the heart and lungs were, then, placed back into the thoracic cavity, and the rib cage was replaced. Then, the abdominal cavity was opened and examined for any fluid/blood. The visceral organs, including the liver, kidneys, spleen, pancreas, and uterus, were taken out, individually weighed and examined. Samples for histopathological examination were collected. The thoracoabdominal cavity was stitched after replacing all the organs, and the body was properly cleaned with the help of 1% sodium hypochlorite and placed in a leakproof plastic bag. The whole used material was discarded as per biomedical waste management guidelines [20]. Samples were collected for histopathological examination in 10% neutral formalin-filled plastic containers and transported to respective laboratories taking all required precautions.

RESULTS

During the study period, ten confirmed cases of COVID-19-positive cases were brought for autopsy in the mortuary associated with the Department of Forensic Medicine and Toxicology, Government Medical College, Amritsar.

The clinicopathological parameters of COVID 19 cases is as depicted (Table 1).

Gross findings of various organs during autopsy include that of lungs showing relatively unremarkable lungs with mild edema and consolidation, brain showing edema and subarachnoid hemorrhage, pancreas showing necrotic and hemorrhagic changes, and kidneys were flea bitten and were contracted.

DISCUSSION

There are a lot of challenges present in the execution of the autopsy of SARS-CoV-2-positive dead bodies to the person carrying the procedure. The most important is minimizing the spread of infection in staff carrying out the autopsy and also preventing the spread of virus/disease outside the room, where the autopsy is conducted. Other is the dire need to carry out the autopsy quickly as soon as possible so as to get the maximum of the gross as well as histopathological findings. Damage to tissue from autolysis may lead to the loss of significant findings [21]. This is an attempt to report complete autopsies on COVID-positive deaths from India.

A similar number of cases were autopsies of the COVID-19 dead bodies in the study conducted by Youd *et al.* (2020) [22], where a total of nine autopsies were conducted, and all the autopsies were conducted on the orders of the coroner/magistrate, and no consent from the deceased relatives was required, and the intention was finding the cause of death. In another study by Yadav *et al.* (2021) [23], which was a prospective observational study conducted on non-medicolegal cases where major obstacle was taking consent from the relatives of the deceased. The usefulness and importance of the clinical knowledge and details of the deceased were emphasized by Carpenito *et al.* (2020) [21] and have been one of the important steps in the present study. It helped in noticing the pathological changes which could be attributed to chronic illness or the treatment and also which samples needed to be collected and preserved.

The earliest attempt to report of complete autopsy citing the findings of the disease in available literature is from Oklahoma, which reflected virus-related pathology [22]. Later, the same authors, further, emphasized that the diagnosis of COVID-19 would have been missed without an autopsy, and hence, it proved that complete autopsies in case of COVID-19 cases were critical for confirmation of the viral infection as well as distinguishing the potential confounders from the true virus-related pathology [24]. The gross findings of the present study are consistent with the study conducted by Yadav *et al.* (2021) [23], Parekh *et al.* (2021) [25], and Lacy *et al.* (2020) [26].

In our experience, the biggest obstacle was the lack of basic infrastructure to carry out the high-risk autopsies as the mortuary setups in India are the most neglected area of the hospitals and lack the basic amenities and facilities to conduct even the routine non-infectious autopsies. Thus, to conduct the high-risk and highly infectious autopsy cases in each setup, keeping in view the recommendations as well as facilities available, customized protocols are needed to be developed. So far, no case was reported of contracting the COVID-19 disease by any autopsy team, validating the fact that proper measures taken in safeguarding the autopsy surgeons with proper use of PPE kits thus relate to the available facts [4,5]. In the present study, there is a major focus on methods and modifications that need to be adopted while conducting highly infectious cases. The authors, thus, recommend covering the dissected area with

Table 1: The clinicopathological parameters of COVID-19 cases

Age (in years) range and mean	24–60 years (49.5)
Sex M: F ratio	4:1
Postmortem interval (hours)	
Comorbidities	
Diabetes mellitus	4 (40%)
Obesity	7 (70%)
Hypertension	9 (90%)
Coronary artery disease	3 (30%)
Others	2 (20%)
Nasopharyngeal RT PCR positivity	9 (90%)

the gauze piece, which minimizes the spread of aerosols, similar to the study conducted by Yadav *et al.* (2021) [23].

CONCLUSION AND RECOMMENDATIONS

Although a complete autopsy is desired to provide the best possible understanding of the disease process, its variants, such as core biopsies and echopsies, can be taken up as safer alternatives, especially in resource-limited centres. Experience, preparation, and experience are the significant vital aspects which help in managing the COVID-19-positive autopsy. Thus, this study emphasizes the fact that conducting of COVID-19-positive autopsy is challenging and needs basic infrastructure as per the guidelines, and medical institutions should be encouraged to conduct pathological autopsies to understand the disease, which will be helpful for humanity in trying times. The institution needs to develop guidelines as well as standard operating procedures for the smooth and safe conduct of autopsies in COVID-19 dead bodies. The limitations of the present study are the small number of cases and that too from a single center. Moreover, there is a missing link to any direct viral organ infection.

AUTHORS' CONTRIBUTION

Dr Jaspinder Pratap Singh: Data collection applying statistics, rechecking data, and validation and help in preparing the manuscript.

Dr Manpreet Kaul: Literature search and help in preparing the manuscript.

CONFLICTS OF INTEREST

None.

AUTHORS FUNDING

None.

REFERENCES

- Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, *et al.* Genomic characterisation and epidemiology of 2019 novel coronavirus: Implications for virus origins and receptor binding. *Lancet* 2020;395(10224):565-74. doi: 10.1016/S0140-6736(20)30251-8, PMID 32007145
- Centers for Disease Control and Prevention. Collection and Submission of Postmortem Specimens from Deceased Persons with Confirmed or Suspected COVID-19. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidancepostmortem-specimens.html> [Last accessed on 2020 Mar 26].
- Occupational Safety and Health Administration (OSHA). COVID-19 Control and Prevention. Available from: <https://www.osha.gov/SLTC/covid19/controlprevention.html> [Last accessed on 2020 Mar 26].
- Hanley B, Lucas SB, Youd E, Swift B, Osborn M. Autopsy in suspected COVID-19 cases. *J Clin Pathol* 2020;73:239-42. doi: 10.1136/jclinpath-2020-206522, PMID 32198191
- World Health Organization. Infection Prevention and Control for the Safe Management of a Dead Body in the Context of COVID-19: Interim Guidance. Geneva: World Health Organization; 2020.
- Fineschi V, Aprile A, Aquila I, Arcangeli M, Asmundo A, Bacci M, *et al.* Management of the corpse with suspect, probable or confirmed COVID-19 respiratory infection-Italian interim recommendations for personnel potentially exposed to material from corpses, including body fluids, in morgue structures and during autopsy practice. *Pathologica* 2020;112:64-77. doi: 10.32074/1591-951X-13-20, PMID 32324727
- Salerno M, Sessa F, Piscopo A, Montana A, Torrisi M, Patanè F, *et al.* No autopsies on COVID-19 deaths: A missed opportunity and the lockdown of science. *J Clin Med* 2020;9:1472. doi: 10.3390/jcm9051472, PMID 32422983
- Fusco FM, Scappaticci L, Schilling S, De Iaco G, Brouqui P, Maltezos HC, *et al.* 2009 cross-sectional survey of procedures for post-mortem management of highly infectious disease patients in 48 isolation facilities in 16 countries: Data from EuroNHID. *Infection* 2016;44:57-64. doi: 10.1007/s15010-015-0831-5, PMID 26267332
- Rakislova N, Fernandes F, Lovane L, Jamisse L, Castillo P, Sanz A, *et al.* Standardization of minimally invasive tissue sampling specimen collection and pathology training for the child health and mortality prevention surveillance network. *Clin Infect Dis* 2019;69:S302-10:S302-10. doi: 10.1093/cid/ciz565, PMID 31598667
- Castillo P, Ussene E, Ismail MR, Jordao D, Lovane L, Carrilho C, *et al.* Pathological methods applied to the investigation of causes of death in developing countries: Minimally invasive autopsy approach. *PLoS One* 2015;10:e0132057. doi: 10.1371/journal.pone.0132057, PMID 26126191
- Keten D, Okdemir E, Keten A. Precautions in postmortem examinations in Covid-19-Related deaths: Recommendations from Germany. *J Forensic Leg Med* 2020;73:102000. doi: 10.1016/j.jflm.2020.102000, PMID 32658758
- Kim MY, Cheong H, Kim HS, Working Group for Standard Autopsy Guideline for COVID-19 from The Korean Society for Legal Medicine. Proposal of the autopsy guideline for infectious diseases: Preparation for the post-COVID-19 era (abridged translation). *J Korean Med Sci* 2020;35:e310. doi: 10.3346/jkms.2020.35.e310, PMID 32830471
- Centers for Disease Control and Prevention Centers for Disease Control and Prevention: Collection and Submission of Postmortem Specimens from Deceased Persons with Confirmed or Suspected COVID-19. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-postmortem-specimens.html> [Last accessed on 2020 May 10].
- Osborn M, Lucas S, Stewart R, Swift B, Youd E. Briefing on COVID-19. Autopsy Practice Relating Possible Cases COVID. 2019-nCov, Novel Coronavirus from China;19:2019/2020). London, United Kingdom: Royal College of Pathologists; 2020.
- Rakislova N, Marimon L, Ismail MR, Carrilho C, Fernandes F, Ferrando M, *et al.* Minimally invasive autopsy practice in COVID-19 cases: Biosafety and findings. *Pathogens* 2021;10:412. doi: 10.3390/pathogens10040412, PMID 33915771
- González-Arnay E, Martín-Olivera R, Quintero-Quintero YC, Hernández-Guerra AI. Proposal for a harmonized protocol for COVID-19 screening and necropsy in forensic sciences facilities. *J Forensic Leg Med* 2020;76:102067. doi: 10.1016/j.jflm.2020.102067, PMID 33032204
- Zhang J, Wang X, Jia X, Li J, Hu K, Chen G, *et al.* Risk factors for disease severity, unimprovement, and mortality in COVID-19 patients in Wuhan, China. *Clin Microbiol Infect* 2020;26:767-72. doi: 10.1016/j.cmi.2020.04.012, PMID 32304745
- Paganelli CR, Goco NJ, McClure EM, Banke KK, Blau DM, Breiman RF, *et al.* The evolution of minimally invasive sampling in postmortem examination: A narrative review. *Glob Health Action* 2020;13:1792682. doi: 10.1080/16549716.2020.1792682, PMID 32713325
- Castillo P, Martínez MJ, Ussene E, Jordao D, Lovane L, Ismail MR, *et al.* Validity of a minimally invasive autopsy for cause of death determination in adults in Mozambique: An observational study. *PLoS Med* 2016;13:e1002171. doi: 10.1371/journal.pmed.1002171, PMID 27875530
- Guidelines for Handling, Treatment and Disposal of Waste Generated During Treatment/Diagnosis/Quarantine of COVID-19 Patients; 2020. Available from: <https://www.mohfw.gov.in/pdf/63948609501585568987/wastesguidelines.pdf> [Last accessed on 2020 Jul 28].
- Carpenito L, D'Ercole M, Porta F, Di Blasi E, Doi P, Fagara GR, *et al.* The autopsy at the time of SARS-CoV-2: Protocol and lessons. *Ann Diagn Pathol* 2020;48:151562. doi: 10.1016/j.anndiagnpath.2020.151562, PMID 32653819
- Youd E, Moore L. COVID-19 autopsy in people who died in community settings: The first series. *J Clin Pathol* 2020;73:840-4. doi: 10.1136/jclinpath-2020-206710, PMID 32605920
- Yadav J, Patel B, Mahaluxmi S, Js S. COVID-19 autopsy in India: Protocols, procedures, and experiences. *Cureus* 2021;13:e18984. doi: 10.7759/cureus.18984, PMID 34820239
- Barton LM, Duval EJ, Stroberg E, Ghosh S, Mukhopadhyay S. COVID-19 autopsies, Oklahoma, USA. *Am J Clin Pathol* 2020;153:725-33. doi: 10.1093/ajcp/aqaa062, PMID 32275742
- Parekh U, Kanchan T, Krishan K. Inexplicable COVID-19! Would pathological autopsy be the panacea? *Acta Biomed* 2021;92:e2021175. doi: 10.23750/abm.v92i1.11019, PMID 33682800
- Lacy JM, Brooks EG, Akers J, Armstrong D, Decker L, Gonzalez A, *et al.* COVID-19: Postmortem diagnostic and biosafety considerations. *Am J Forensic Med Pathol* 2020;41:143-51. doi: 10.1097/PAF.0000000000000567, PMID 32379077